

Research Article

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Single-Port Laparoscopic Surgery in Extensive Peritoneal and Ovarian Endometriosis

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Abstract

Objective: The aim of this study was to assess the feasibility and safety of Single-Port Access (SPA) Laparoscopic Complete Excision (LCE) in severe endometriosis of the adnexa and pelvic peritoneum.

Methods: The surgical outcomes of 40 consecutive patients that underwent SPA-LCE were compared with those from the control group with conventional LCE.

Results: The mean operating time was 102 min for the SPA group and 103.4 min for the conventional group, respectively ($P=0.899$). Both groups had the same estimated blood loss (50 mL). The mean postoperative hospital stay of the SPA group was 1.9 days and shorter than that for the conventional group (2.8 days, $P=0.008$). The mean postoperative pain score after 48-hours of the SPA group was lower as compared to that of the conventional group (1.9 vs. 2.8, $P=0.001$). There was no operative complication in either group.

Conclusion: SPA-LCE was feasible as a minimal invasive surgery for the treatment of severe endometriosis of the adnexa and pelvic peritoneum.

Keywords: Severe endometriosis; Laparoscopy; Single-port

Introduction

Severe endometriosis, including deep infiltrating endometriosis, is responsible for refractory pelvic pain, of which the intensity is correlated with the depth of infiltration. Histologically, it is considered an aggressive form of endometriosis that penetrates more than 5 mm under the peritoneal surface [1,2]. Moreover, it results in extensive pelvic adhesions and distortion of pelvic anatomy, which can lead to infertility at childbearing age. The surgical management for severe endometriosis is a complex procedure that requires an accurate balance between the need of complete excision of the endometriotic lesion and the need to avoid any morbidity associated with radical surgery. Both operators and patients always have concerns about endometriosis recurrence in spite of the performance of radical surgery, which may cause major operative complications, including bowel or bladder injury [3-5]. First of all, young women require minimally invasive surgery with a minimal operation scar, reduced postoperative pain, and a quick return to their ordinary life. For this reason, the laparoscopic approach has been performed as a standard treatment in patients with severe and extensive endometriosis limited to the uterus, bladder, peritoneum, cul-de-sac, and adnexa [6,7].

Recently, with improvements in surgical expertise with optimal instrumentation, many surgeons have attempted to reduce the number and size of the ports in laparoscopic surgery in order to reduce morbidity and improve cosmetic outcome. Compared with conventional laparoscopy, a Single-Port Access (SPA) laparoscopy is expected to offer reduced postoperative pain and better cosmetic results and, because it involves fewer trocars, may help to avoid operative complications related to trocar insertion [8,9]. However, SPA surgery has systemic limitations, including a clash between instruments or between the instruments and the endoscope, a limited amount of instruments, and limited mobility of straight laparoscopic instruments due to the instruments all having to work in one port. The authors have tried to overcome these technical difficulties using several tips for a SPA laparoscopy. Consequently, we considered that a SPA laparoscopy would be a good surgical option in severe endometriosis limited to the adnexa and pelvic peritoneum or the uterosacral ligament. The aim of this study was to assess the feasibility and safety of a SPA-Laparoscopic

Complete Excision (LCE) in patients with severe endometriosis of the adnexa and pelvic peritoneum and to compare the surgical outcomes of the SPA and conventional LCE.

Materials and Methods

Patients

We evaluated 80 consecutive patients suffering from pelvic pain that underwent SPA-LCE ($n=40$) or conventional LCE ($n=40$) for severe endometriosis of the adnexa and pelvic peritoneum from March 2009 to March 2011 in our institution. Written informed consent was obtained from all patients prior to surgery. This study was exempt from the Institutional Review Board approval of Yonsei University Health System because this was retrospective study. Gynecologic pathologists confirmed all surgical specimens and reported the presence of endometriosis and deep endometriosis. A deep lesion was defined as endometriosis that was characterized by proliferative strands of glands and stroma in dense fibrous and smooth muscle tissue [10]. Then, the surgical staging of endometriosis was determined according to the classification of the revised American Society for Reproductive Medicine (rASRM) [11]. The inclusion criteria were confined to patients who had stage IV endometriosis. These patients had severe dysmenorrhea or chronic pelvic pain and their radiologic imaging showed a unilateral or bilateral adnexal mass. All patients who underwent this surgery wanted relief from the symptoms and to preserve fertility. SPA-LCE was performed by two surgeons (J.P and

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S.W.K) who have more than 300 cases of SPA gynecologic surgery experiences. The conventional approaches were performed by two skilled gynecologic laparoscopists who had more than 300 experiences of conventional laparoscopy for adnexal disease. We performed a SPA laparoscopy through only one 1.5-cm sized incision in the umbilicus and used the existing instruments that were utilized for conventional laparoscopy. The surgical techniques were the same as those of conventional laparoscopy. General data pertaining to patient characteristics, the existence of symptoms, the disease location, and the stage and score for the disease according to the rASRM classification were retrospectively collected from medical records. Surgical outcomes, including operating times, the presence of pelvic adhesions, Estimated Blood Loss (EBL), a drop in serum hemoglobin (Hb) (change between the preoperative Hb and the Hb 1 day after surgery), postoperative pain scores, operative complications, and the postoperative hospital stay length were evaluated through medical record review. The operating time was defined as the interval from umbilical skin incision to the completion of skin closure. Postoperative pain assessments were performed in all patients using a validated visual analogue scale. The scale was presented as a score from 0 to 10, with verbal descriptors anchored with 'no pain' and 'agonizing pain'. Patients were asked to rate their pain intensity at immediate, 6, 24, and 48 hours after surgery. To manage postoperative pain on a general ward, ketorolac 30 mg was injected intramuscularly as the primary analgesic. After a soft diet was permitted, a nonsteroidal anti-inflammatory drug (etanercept 300 mg) was administered three times daily as the primary analgesic medication if there was no demand for other analgesics from the patient.

For statistical analysis, the frequency distributions were compared using a Chi-square test, and the mean or median values were compared using Student's *t*- and Mann-Whitney U-tests. All statistical tests were 2-tailed. All P values of <0.05 were considered statistically significant. The data were analyzed using SPSS software, version 12.0 (SPSS Inc, IL, USA).

Surgical techniques

The SPA system was performed according to a technique previously described by our group [8]. In brief, a Foley catheter was inserted into the bladder, and a uterine manipulator was inserted in the endometrial cavity after general endotracheal anesthesia. After making a 1.5-cm vertical intra-umbilical skin incision, the Alexis® wound retractor (Applied Medical, CA, USA) was inserted into the peritoneal cavity through the umbilicus. A 7½ surgical glove was fixed to the outer ring of the wound retractor. After making small incisions in the finger tip portions of the glove, two 5 mm trocars and one 11 mm trocar were inserted. A rigid 30 degree, 5 mm, endoscope 45 cm long was used (Figure 1). For the conventional approach, two or three 5 mm trocars and one 10 mm trocar were inserted and a rigid 30 degree, 10 mm endoscope 30 cm in length was used. The surgical instruments used were conventional laparoscopic devices and Harmonic Ace™ (Ethicon Endo-surgery, Ohio, USA).

The surgical procedures of LCE included an ovarian cystectomy, pelvic peritonectomy, electrocauterization of endometrial spots, and a lesion resection at the rectovaginal septum and uterosacral ligament. The procedure began with adhesiolysis. After identifying the correct plane of cleavage between the wall of the cyst and the ovarian tissue by applying opposite bimanual traction with two 5 mm biopsy forceps, the inner lining of the cyst was stripped from the normal ovarian tissue (Figures 2A and 2C). For a pelvic peritonectomy, the first surgical step consisted of opening the peritoneum and submitting the ureter to a careful blunt dissection. The dissection started where the ureter

was clearly visible and was without adhesions and it progressed in the direction of the uterosacral ligaments until it crossed with the uterine vessels. At the end of the dissection, the ureter had to be completely mobilized and visible from the pelvic brim to its cross with the uterine vessels (Figure 2B). The lesion was grasped with forceps and then, using a monopolar hook or a Harmonic Ace™, the peritoneum and endometriotic lesions were excised. For an obliteration of the cul-de-sac, a shaving of the rectal serosa and posterior pelvic peritonectomy was performed after the rectovaginal septum was completely dissected. After removal of all the lesions, there were sufficient borders between the lesions and healthy peritoneum (Figure 2D).

Results

The characteristics of the patients and the laparoscopic findings of both groups are shown in table 1. The two groups were similar in terms of patient and disease characteristics. On the laparoscopic findings, the mean rASRM score was 64.4 (Standard Deviation (SD), 14.8) for SPA group and 65.4 (SD, 14.6) for the conventional group, respectively. All had endometriotic lesions in the adnexa and pelvic peritoneum. Fourteen in the SPA group and 12 in the conventional group had severe lesions of uterosacral ligaments and underwent a complete peritonectomy without resection of the uterosacral ligaments. Four patients in either group had severe lesions of bladder; however, these patients underwent only a peritonectomy without bladder surgery, including a partial cystectomy. The surgical outcomes are listed in

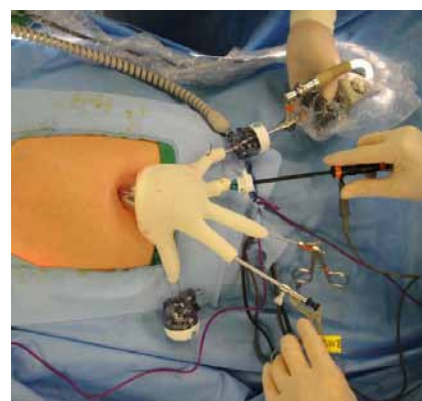


Figure 1: External view of single multichannel-port system using a wound retractor and surgical gloves.

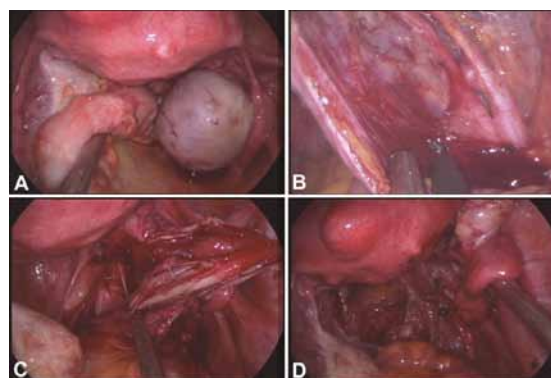


Figure 2: Intraoperative view (A) overview of the pelvis, (B) dissection of the ureter, (C) the stripping of the endometrial cyst from the normal ovarian tissue, (D) view after pelvic peritonectomy.

table 2. The mean operating time was 102 (SD, 31.5) min for the SPA group and 103.4 (SD, 35.3) min for the conventional group. There was no statistical difference. Both groups had the same values of the median EBL (50 mL). The mean postoperative hospital stay of the SPA-LCE group was 1.9 (SD, 0.6) days which was shorter than that of the conventional LCE group (2.8 days (SD, 1.0), $P=0.008$). There was no required transfusion or operative complication in either group.

Postoperative pain scores immediately, after 6 hours, and 24 hours did not significantly differ between the SPA-LCE group and the conventional LCE group. However, the mean postoperative pain score after 48 hours of the SPA-LCE group was lower as compared to that of the conventional LCE group with statistical significance (1.9 vs. 2.8, $P=0.001$). There was no difference in the total amount of requested analgesics between the two groups. Additionally, there was no difference of pain between postoperative intravenous patient controlled analgesia (IV-PCA) group and non IV-PCA group (data not shown).

Discussion

To successfully perform LCE for severe endometriosis of adnexa and pelvic peritoneum, a complete dissection of the ureter is essential. However, the pelvic anatomy is distorted by dense fibrotic adhesions,

which cover the deep infiltrating lesions and cause the contraction of the pelvic tissues. Therefore, a severe pelvic adhesion or obliteration of the cul-de-sac does not allow an operator to easily perform surgical procedures. Furthermore, technical problems of the SPA laparoscopy cause lower accuracy of the operation as compared to conventional laparoscopy. The authors have solved the technical problems in SPA surgery using conventional laparoscopic instruments [12]. Firstly, a 45 cm length, 5 mm diameter, and 30 degree angled endoscope and a 90 degree light cable adaptor were used to avoid collision between the endoscope and surgical instruments. Using a 30 degree angled endoscope allowed an operator to see the field that was invisible when using a 0 degree endoscope, including the posterior aspect of the uterus and adnexa or lesion of a deep cul-de-sac. Additionally, the authors made the middle portion of toothed biopsy forceps slightly curved thereby avoiding the collision of surgical instruments. For traction of tissue, a 2 mm grasper was added. This instrument was flexible so that adding it did not cause a crash between other surgical instruments. Of the procedures for SPA-LCE, the stripping of ovarian cysts, and complete dissection of the ureter, and complete excision of lesions in the deep cul-de-sac, which require surgical techniques due to systemic difficulties, were completed using these laparoscopic instruments. As a result, we could successfully perform SPA-LCE in a reasonable time period compared to conventional LCE without operative complication.

	SPA-LCE (n=40)	Conventional LCE (n=40)	P value
Mean Age (years, SD)	33.2 (4.7)	35.1 (5.5)	0.248
Mean body mass index (kg/m ² , SD)	20.8 (1.9)	21.0 (1.8)	0.640
Previous abdominal surgery histories	10 (25%)	10 (25%)	1.000
Previous surgery for endometriosis	2 (0.5%)	2 (0.5%)	1.000
Infertility	4 (10%)	6 (15%)	0.657
Gynecologic symptoms			
Dysmenorrhea	36	40	
Dyspareunia	6	8	
Chronic pelvic pain	20	20	
Bowel symptoms	0	0	
Urologic symptoms	2	2	
Mean rASRM score (SD)	64.4 (14.8)	65.4 (14.6)	0.831
Mean maximum size of endometrioma (cm, SD)	5.4 (1.8)	6.1 (2.0)	0.291
Presence of bilateral ovarian tumor	18 (45%)	20 (50%)	0.752
Other location			
Uterosacral ligament	14	12	
Bladder	3	1	

SPA: Single-Port Access; LCE: Laparoscopic Complete Excision; SD: Standard Deviation; rASRM: revised American Society for Reproductive Medicine

Table 1: Clinical characteristics and operative findings in study subjects.

	SPA-LCE (n=40)	Conventional LCE (n=40)	P value
Mean operating time (min, SD)	102 (31.5)	103.4 (35.3)	0.899
Median estimated blood loss (mL, IQR)	50 (88)	50 (108)	0.779
Median hemoglobin drop (g/dL, IQR)	1.5 (1.0)	1.0 (1.0)	0.414
Mean postoperative hospital stay (days, SD)	1.9 (0.6)	2.8 (1.0)	0.008
Operative complication rates	0	0	1.000
Patients with IV-PCA	8 (20%)	6 (15%)	0.677
Mean postoperative pain score (SD)			
Immediate	2.8 (0.8)	2.7 (0.7)	0.668
6 hrs	3.8 (1.2)	4.2 (1.4)	0.330
24 hrs	2.6 (0.8)	3.0 (1.2)	0.220
48 hrs	1.9 (0.5)	2.8 (1.0)	0.001
Total requests of analgesics (SD)	14.1 (4.4)	13.8 (3.8)	0.925

SPA: Single-Port Access; LCE: Laparoscopic Complete Excision; SD: Standard Deviation; IQR: Interquartile Range; IV-PCA: Intravenous Patient Controlled Analgesia

Table 2: Comparison of Surgical Outcomes Between the Groups.

On the other hand, the postoperative pain of the SPA group was less than that of the conventional group and the differences of pain between the groups were great in the process of time. Consequently, in the SPA group, the low postoperative pain could lead to short postoperative hospital stay which allowed patients to return to normal activity as soon as possible.

One of the limitations of this study was the possibility of bias because this study was not designed as a randomized trial. Also, because we focused on the immediate surgical outcomes, endometriosis-related pain or pregnancy outcomes after surgery was not assessed. For another limitation, it is difficult to conclude that the SPA group has a shorter postoperative hospital stay because we discharged the patients without defined standards. The putative advantages of the SPA system include enhanced cosmetic results from a hidden umbilical scar, a decrease in morbidity related to bowel and vascular injury during trocar placement, and a decreased postoperative wound infection and hernia formation. To clarify the benefits of the SPA-LCE and to complement the limitations of this study, a prospective randomized trial and long-term follow up are needed.

Conclusion

For surgical treatment in patients with severe endometriosis of adnexa, pelvic peritoneum or uterosacral ligament, SPA-LCE could be a feasible procedure for experienced laparoscopic surgeons.

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